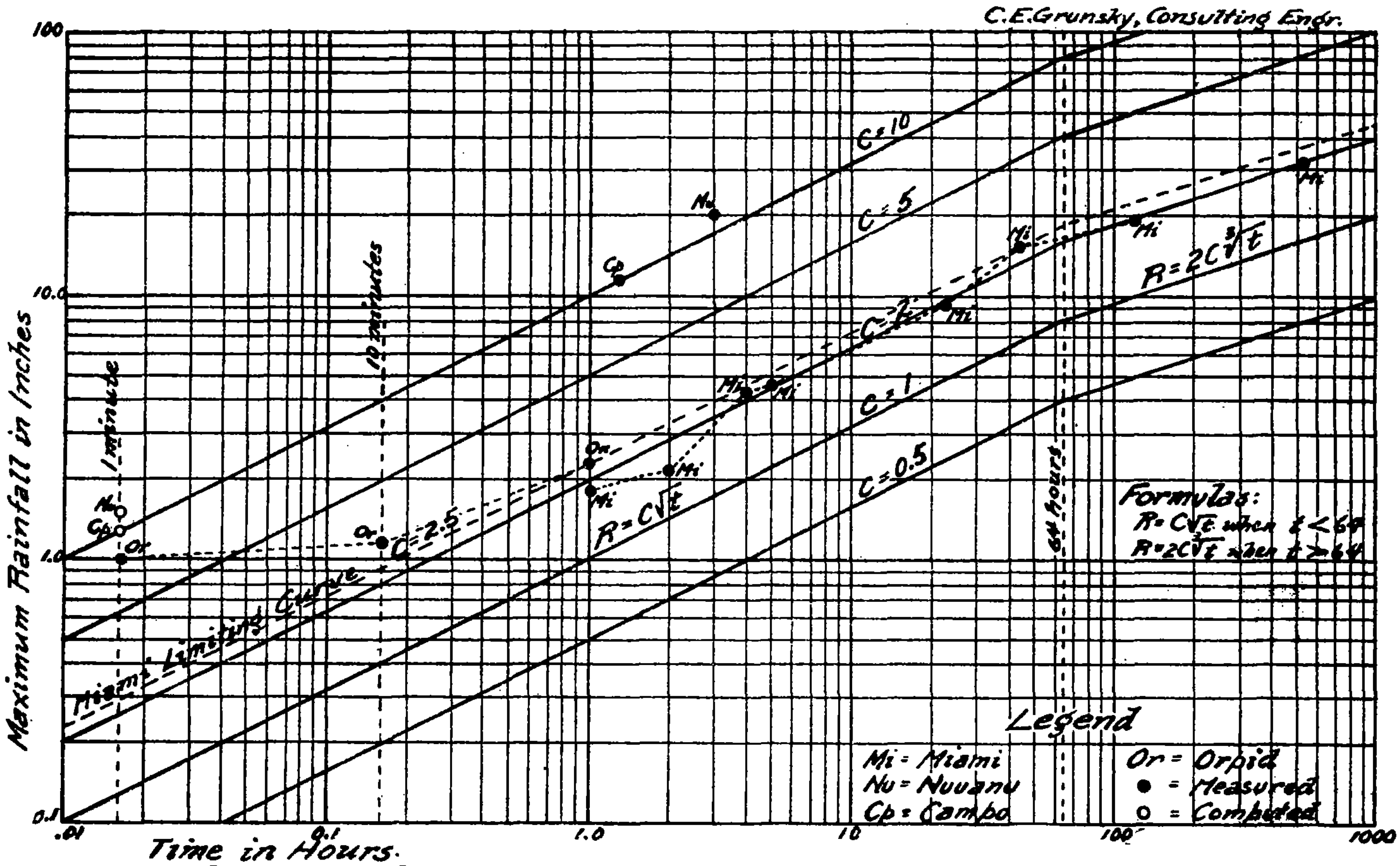
The experienced meteorologist will know that values of the coefficient C determined by actual measurement of very heavy rainfall during short periods of time, such as a few minutes or an hour or two, may not be applicable to long periods of time such as a week, month, or longer, and vice versa. The formulas are particularly helpful in approximating probable maximum amounts of rain over a considerable range of time in both directions from the time periods covered by actual observation.



PROBABLE RAINFALL MAXIMA IN VARIOUS TIME PERIODS.

LOGARITHMIC SCALES.

ANALYSIS OF THE PRECIPITATIONS OF RAIN AND SNOW, DURING 1929–30, AT MOUNT VERNON, IOWA

By WILLARD C. STEWART

Under the direction of Dr. Nicholas Knight, of Cornell College, advanced students of chemistry have made analyses of the rains and snows that have been precipitated here for the past 20 years. The results of most of the work have been published in scientific journals.

The precipitations are collected in clean granite pans, 18 inches in diameter, away from trees and buildings and stored in glass-stoppered bottles. The village has no factories, and, exclusive of the college, has a population of about 1,700.

In estimating the chlorides, it has been found necessary to deduct 3.55 parts per million from the reading, to allow for the formation of the color. For the most part, the precipitations come from the East or South which signifies that the salt is carried by the winds from the Atlantic Ocean or the Gulf of Mexico. As our previous results in chlorides have received some criticism as seeming rather high, we have taken special pains to secure the accuracy of the results given in this paper, and we believe they are correct.

The processes of these analyses are taken from Standard Methods of Water Analysis, sixth edition, published by the American Health Association. Practically all the samples analyzed were colorless. The results are given in the following tables. The numbers express the parts of the various substances in a million parts of water.

TABLE 1.—*Rain and snow at Mount Vernon, Iowa*

Number of sample	Date of precipitation	Amount	Rain or snow	Nitrates	Nitrites	Free ammonia	Albumenoid ammonia	Sulphates	Chlorine as chlorides
	1929								
1	June 11	0.3	Rain	0.04	0.0014	0.056	0.4		14.20
2	June 12	0.6	do	0.5	0.08	0.056	Traces.		17.75
3	June 13	0.6	do	0.12		0.026	0.112		17.75
4	June 30	0.8	do	0.4	0.003	0.8	0.16		17.75
5	July 19	0.3	do	0.02	0.0014	0.112	0.16		21.35
6	Sept. 16	0.25	do	0.8	Traces.		0.29		17.75
7	Sept. 19	0.25	do	0.6	0.002	0.2			24.85
8	Sept. 29	0.3	do	0.12		0.112	0.29	0.106	
9	Oct. 10	0.3	do	0.16	0.003		0.4		10.65
10	Oct. 12	1.0	do	0.1	0.0014	0.26	0.112		24.85
11	Oct. 20	.75	do	0.24	0.0014	0.600	0.58	1.81	46.15
12	Oct. 23	0.6	do	0.25		0.136	0.64		3.55
13	Oct. 29	0.4	do	0.12	0.0629	0.78	0.64	0.789	11.65
14	Oct. 31	0.4	do	0.4	0.0010	0.5	0.272	2.57	6.45
15	Nov. 10	0.75	do	0.8	0.002	0.006	0.012	1.64	31.95
16	Nov. 13	0.8	do	0.16	0.005	0.02	0.01		6.1
17	Nov. 19	0.2	do	0.0014		0.015	0.07		10.65
18	Nov. 27	0.12	do	0.0025		0.03	0.56		7.81
19	Dec. 1	6	Snow	0.5	0.001	0.26	0.16		16.33
20	Dec. 13	.2	Rain	0.2	0.075	0.2	1.4		2.13
21	Jan. 2	[1] 3	Snow	0.16	0.004	0.72	0.32	0.493	
22	Jan. 7	4	do	0.6	Traces.	0.78	0.16	0.647	24.8
23	Jan. 9	6	do	0.02	0.002	0.6	0.29		7.81
24	Jan. 13	3	do	0.6	Traces.	0.32	0.16		21.3
25	Jan. 14	6	do	0.4	Traces.	0.36	0.16	0.281	10.36
26	Jan. 17	2	do	0.5	Traces.	0.08	0.25	0.044	17.4
27	Jan. 21	2	do	0.3	Traces.	0.36	0.36		4.97
28	Feb. 16	2	do	0.4	Traces.	0.45	0.9	0.233	31.95
29	Feb. 24	0.5	Rain	0.4	0.0001	0.36	0.48	0.013	24.85
30	Feb. 25	0.6	do	0.12	Traces.	0.16	0.112	0.123	42.6
31	do	0.1	do		0.0007	0.36	0.32		3.55
32	Feb. 28	0.18	do	0.03	0.0025	0.36	0.36	0.219	2.6
33	Mar. 17	0.3	do	0.08	0.0015	0.72	0.8	0.815	24.85
34	Mar. 18	0.3	do	0.06	0.0002	0.16	0.36	0.104	10.6
35	Apr. 11	0.4	do	0.16	0.0004	0.36	0.72	0.247	17.45
36	Apr. 13	0.25	do	0.8	0.0001	0.112	0.16	0.195	10.65
37	Apr. 15	1	do	0.5	0.0003	0.32	0.36	0.096	21.3
38	Apr. 16	0.5	do	0.6	0.0001	0.16	0.32	0.123	28.4
39	Apr. 20	1.1	do	0.16	0.0001	0.112	0.64		23.7
40	Apr. 27	0.2	do	0.1	0.002	0.136	0.36		10.65
41	Apr. 29	0.16	do	0.6	0.0025	0.32	0.4		7.1
42	May 1	0.4	do	0.12	0.0025	0.01	0.002		2.75
43	May 2	0.6	do	0.05	0.0014	0.01	0.001		
44	May 4	0.85	do	0.07	0.0025				31.95
45	May 7	0.1	do	0.1	Traces.	0.01	0.01	0.0042	17.75
46	May 11	0.5	do	0.9	0.0025				10.6
47	May 16	0.25	do	0.14	0.02				3.55
48	May 23	1.2	do	0.0016	0.0007				31.95

[1] Inches.

TABLE 2.—*Data from Table 1 converted to pounds per acre*

[1 inch rain over 1 acre=226,875.0 pounds. 12 inches snow=1 inch rain]

Number	Nitrates	Nitrites	Free ammonia	Albuminoid ammonia	Sulphates	Chlorides
1	2.72	0.91	3.8	0.27		0.9664
2	6.80	10.8	7.6	Traces.		2.4162
3	16.33		35.3	0.05		2.4162
4	7.26	5.4	14.5	2.89		3.0202
5	1.36	0.91	7.6	10.8		1.4531
6	4.53			1.64		1.0067
7	3.4	1.13	11.3			1.4094
8	8.16		7.6	5.9	0.0721	
9	10.89	2.0		0.2		0.7248
10	22.68	3.17	58.9	2.54		5.6378
11	40.83	2.26	102.0	9.86	0.3079	7.8527
12	34.03		18.5	8.71		0.4832
13	10.89	16.33	70.7	5.8	0.0559	1.0572
14	3.63	0.9	45.3	2.46	0.4373	0.5853
15	13.61	0.34	1.0	0.81	0.2976	5.4364
16	29.04	0.83	3.5	0.18		1.1071
17	0.00006		0.6	0.3		0.4832
18	0.00006		0.8	0.13		0.2126
19	56.71	1.13	9.4	1.81		1.8524
20	9.07	34.03	1.36	4.70		0.0952
21	4.07	2.26	40.83	1.81	0.0279	
22	4.53		68.98	1.2	0.0489	
23	22.68	2.26	68.6	3.28		0.8359
24	34.03		18.15	0.9		1.2081
25	45.37		40.83	1.81	0.0208	1.1752
26	18.70		3.02	0.94	0.0019	0.7731
27	1.13		13.61	1.34		1.8418
28	1.51		204.18	3.40	0.0105	14.4972
29	1.51	1.23	40.83	5.44	0.0014	1.1275
30	4.53		3.02	7.52	0.0167	5.7988
31		9.52	49.0	0.72		0.8050
32	0.122	10.2	15.01	1.46	0.0089	0.7637
33	10.89	10.2	49.0	0.54	0.0579	1.5637
34	8.16	1.36	10.89	5.44	0.0070	0.7214
35	14.51	3.63	32.67	6.53	0.0224	0.5832
36	4.53	0.567	6.35	0.9	0.0110	0.9664
37	11.34	6.8	95.28	8.16	0.0217	4.8324
38	6.80	1.13	18.15	3.63	0.0139	3.2216
39	39.91	2.52	27.95	15.94		5.7574
40	4.51	9.07	6.17	1.63		4.8032
41	2.17	9.07	11.61	0.14		0.1006
42	7.54	22.68	0.9	0.045		0.2495
43	2.71	19.45	1.35	0.013		
44	2.57	48.20				2.5063
45	2.26		0.22	0.02	0.3667	0.4027
46	12.60	45.37				1.0701
47	3.97	278.43				1.5658
48	17.01	3.53				0.781

NOTES, ABSTRACTS, AND REVIEWS

Some Problems of Modern Meteorology[1] *by D. Brunt—I. The present position of theories of the origin of cyclonic depressions.*—The main features of the cyclonic depression of middle latitudes are its center of low pressure and its associated system of winds which blow counterclockwise around this center. Now the pressure at any level measures to a high degree of approximation the mass of air above unit area of horizontal surface at that level. Hence the existence of a center of low pressure denotes that air has been removed from the region, and it is clear that the removal must finally be in a horizontal direction. Theories of the origin of depressions differ fundamentally only in the mechanism which they propose for this removal of air.

It might be thought that a center of low pressure could be formed by air diverging outward from a center, moving everywhere in a horizontal direction. It is known, however, that any body moving over the surface of the earth tends to swing round to the right (in the Northern Hemisphere). Hence the divergence of air from a point would generate a clockwise rotation of the air, and would produce a system of winds opposite to those in the cyclone. The suggestion of accounting for a depression by divergence from the central area is therefore ruled out.

[1] Under this title it is proposed to publish a series of brief articles by various authors discussing some of the unsolved problems of meteorology. They will aim not at advocating new theories, but at stating the difficulties involved in existing theories. (Reprinted from Quarterly Jour. Roy. Met. Soc., July, 1930, pp. 345-350.

The only alternative is convergence towards the central region, which by a similar line of argument is seen to produce a counterclockwise system of winds. The excess of air which would otherwise accumulate in the central region must be removed by vertical motion initially. But since the removal of the superfluous air to a higher level does not in itself produce a decrease of surface pressure, we must further postulate some mechanism capable of removing the superfluous air horizontally. There appears to be only one possible mechanism, an upper current moving with a different velocity and possibly in a different direction, from the currents of lower levels. We are thus led from the general nature of cyclonic depressions to postulate two conditions as necessary for their formation—firstly, an ascending current of air in the lower troposphere, strictly limited in horizontal extent, and secondly, an upper current differing in speed or direction or both, from the currents in the lower troposphere. If the upper current has the same direction as the currents of the lower troposphere, it will be constantly moving forward in advance of the depression, and any clouds formed within it will appear to move outward from the center in the line of advance. These clouds would herald the approach of the depression. If on the other hand the upper current is in a different direction from the currents of the lower troposphere, any clouds formed in the upper current will fail to indicate the line of advance of the